month. The Detroit River was frozen over at Detroit, Mich., on the 15th. The Saint Clair River was frozen from Fort Gratoit, Mich., to Point Edward, Canada, on the 12th, and was frozen over at Port Huron, Mich., on the 27th. Navigation on the Ohio River was interrupted by floating ice.

AURORAS.

On the 5th auroras were reported over the northern part of the country from Washington to New England, and southward to Oklahoma Territory. Auroras were reported in the north-central and northeastern states on the 29th and 30th.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean atmospheric pressure for January, 1892, as determined from observations taken daily at 8 a. m. and 8 p. m. (75th meridian time), is shown on Chart II by isobars.

The normal distribution of pressure for January shows values above 30.20 in two areas, one of which occupies the middle plateau region and the middle-eastern slope of the Rocky Mountains, and the other the interior of the south Atlantic states and eastern Tennessee. From these high areas the barometric gradient is marked northeastward to the Iceland low area and northwestward to the area of low pressure of Bering Sea, and the normal pressure is below 30.00 over the Gulf of Saint Lawrence and on the extreme north Pacific coast. In this month there is a general increase of pressure over the United States, and the highest pressure of the year usually obtains over parts of the middle-eastern and southeastern districts.

In January, 1891, the mean pressure was highest over the middle plateau region, where it was above 30.30, whence it decreased to about 30.05 on the south Pacific and extreme north Pacific coasts. The lowest mean pressure of the month was noted over eastern Canada and eastern New England, where it was below 30.00, from which region there was an increase of pressure to the south Atlantic and east Gulf states, where the mean values were above 30.15.

Chart IV shows that high pressure was persistent over the middle plateau, and Chart I shows that no low pressure areas traversed that region during the month.

A comparison of the pressure chart for January, 1892, with that of the preceding month shows an increase of pressure, except in districts east of the lower Mississippi River and south of the Lake region, and in California and southern Arizona. The greatest increase of mean pressure occurred from northern Missouri over Minnesota, the Dakotas, eastern Montana, and the British Possessions to the northward, where it exceeded .25, and the most marked decrease was noted along the Atlantic coast between the 33d and 39th parallels, where it was more than .15. Along the California coast south of the 38th parallel the decrease was .10.

The mean pressure was above the normal from the west Gulf states and the Mississippi Valley over the middle and northern plateau regions to the Oregon and Washington coasts, the most marked departure above the normal being shown in an area extending from the middle plateau to west Washington, where it was more than .10. Over the eastern and extreme southwestern parts of the country and in the British Possessions the mean pressure was deficient, and at stations in those districts the mean values were .05, or more, below the normal pressure for the month.

HIGH AND LOW AREAS.

The paths of well-defined areas of high and low pressure for January, 1892, are shown on Charts IV and I, respectively, and some of the more prominent characteristics of the high and low areas are noted in the table at the end of this chapter.

HIGH AREAS.

Ten high areas appeared, the average number traced for January during the last 17 years being 9. Two of the high areas advanced from the Pacific coast north of the 45th parallel; 4 first appeared over the British Northwest Territory; 3 apparently developed over the middle plateau region; and one passed northeastward from the lower Rio Grande valley. One of the Pacific coast high areas, number V, traversed the continent, the average rate of advance being 26 miles per hour, and one of the high areas which appeared over the middle plateau region moved thence northwestward to western Washington and Oregon, thence to Alberta, thence along the eastern slope of the Rocky Mountains to southeastern Texas, and thence eastward over the north part of the Gulf of Mexico and Florida. High pressure prevailed during a great part of the month over the middle plateau region. Three of the high areas traced were offshoots from, and one of the Pacific coast high areas merged into, the permanent high area of the middle plateau. The high areas that appeared north of the 50th parallel generally moved southeastward after crossing the Rocky Mountains, and one high area moved eastward from the middle plateau region to the middle Atlantic states. The following is a description of the high areas referred to:

I.—The month opened with a ridge of high pressure extending from Manitoba to the south Pacific coast, which separated two low areas, one, number I, occupying the middle Mississippi valley, and the other, number II, the north Pacific coast. The pressure was also high off the middle Atlantic coast, high areas XI and XII for December, 1891, having moved to that region during the night of December 31–January 1st. High area I was central over Utah, with pressure above 30.50, and temperature below freezing was noted over the plateau region to the Mexican border, the lowest temperature of the month being recorded at Red Bluff, Keeler, and San Diego, Cal., and Yuma, Ariz., where it was 32°, 23°, 38°, and 32°, respectively. The high area remained nearly stationary over the middle plateau during the 2d and 3d, with pressure rising above 30.70 at Montrose, Colo., the evening of the 1st and the morning of the 2d. By the 4th it had shifted position to western Oregon, and passed thence north of Montana during the 5th. Moving rapidly southeastward along the eastern slope of the Rocky Mountains the center reached southeast Texas the night of the 6th, carrying the line of freezing weather to central Texas and the north part of the Gulf States. Passing eastward over the north Gulf the center passed over the north part of the Florida Peninsula the night of the 7th, with freezing weather along the immediate east Gulf coast and over northern Florida. The temperature continued low over the southeastern part of the country until the 9th. At Jacksonville, Fla., the temperature fell to 31°.7 the morning of the 8th, the lowest temperature of the season at that place, and vegetation was injured by cold as far south as Jupiter, Fla.

II.—Was central over Assiniboia the morning of the 1st, with pressure above 30.40, and temperature below zero over the Dakotas and eastern Montana, and an increase of pressure of .60 in 12 hours at Fort Smith, Ark. During the 2d the high area moved eastward over Manitoba, with freezing weather to central Texas and the interior of the Gulf States, and a temperature fall of more than 40° in 24 hours in western Ontario. The morning of the 3d the area was central north of Lake Superior, the line of freezing weather extended to the north part of the Florida Peninsula, and frost occurred as far south as Jupiter and Tampa, Fla. During the 4th this high area disappeared by a decrease of pressure north of the eastern Lake region. On this date the pressure was high, above 30.20, over the Florida Peninsula, and heavy frost caused great damage to vegetation as far south as Jupiter, Fla.

III.—The approach of this high area from the British Northwest Territory was shown by reports of the 7th, an increase of

pressure of .38 in 12 hours occurring at Qu'Appelle, N. W. T. The evening of the 8th the area was central north of Montana, with pressure above 30.50. The morning of that date the line of freezing weather extended from central New Mexico south of east to northern Florida. Moving rapidly southeastward the high area reached the middle Mississippi valley the evening of the 9th, whence it advanced eastward to Pennsylvania by the morning of the 10th, and thence northeastward to the Gulf of Saint Lawrence by the 11th, with a gradual increase of pressure, readings above 30.80 being noted over the north part of the Gulf of Saint Lawrence on the 11th.

IV.—On the 10th a ridge of high pressure extended over the northern part of the country from the Canadian Maritime Provinces to the Pacific coast, with two areas of higher pressure, one, number III, in the Northeast, and the other, number IV, on the northeast slope of the Rocky Mountains. By the evening of the 11th the high pressure over the western part of the country showed two centers, one over the northern plateau, and the other, number IV, on the middle-eastern slope of the Rocky Mountains. The morning of the 12th the separate high areas had merged into one and occupied the middle-eastern slope, with pressure above 30.60. It remained nearly stationary in that region during the 12th, and by the morning of the 13th shifted position westward to the middle plateau region, where the pressure continued high until after the 15th. On the 10th the temperature fell below zero in the Dakotas, Wyoming, Minnesota, Wisconsin, and Upper Michigan. On the 11th the line of zero temperature extended over Colorado, and the 24-hour temperature fall was 24° at Cheyenne, Wyo. On the 12th zero temperature occurred over Kansas, northern Missouri, and central and northern Illinois, and the temperature was below freezing in Texas, except along the coast line. On the 13th the temperature fell below freezing along the Gulf coast of Texas, and the 24-hour temperature fall was more than 20° on the middle Gulf coast. The morning of the 14th the pressure was high, 30.60, at San Antonio, Tex., clear weather had followed the cloudy and rainy condition attending low area VI, the first heavy frost of the season occurred at Galveston, Tex., and the line of freezing weather extended from the east Gulf coast along the line of the Alleghany Mountain range to the lower Saint Lawrence valley. On this date the 24-hour temperature fall was more than 20° over the interior of the south Atlantic states. The cold wave which originated with this high area caused loss of stock on the ranges of Texas.

V.—Apparently advanced from the Pacific Ocean, and the evening of the 12th was central north of Washington, with pressure above 30.60, and freezing weather southward over the Sacramento and San Joaquin valleys, Cal. During the 13th the center moved eastward north of Montana, with slight pressure changes, and passed thence slowly eastward north of the Dakotas during the 14th, with pressure above 30.80, zero temperature to northern Kansas, and a temperature fall of 38° in 24 hours at White River, Ont. During the 15th the high area moved north of Lake Superior, with a slight decrease of pressure. The line of zero temperature extended to northern Missouri and central Illinois, the temperature was below freezing to the Gulf coast, and the 24-hour temperature fall was more than 30° in western Ontario and in areas in the middle Atlantic and New England states. During the 16th the center advanced from north of the Lake region to eastern New York, where it was joined by high area Va, which had moved from the upper Ohio valley; freezing weather occurred along the Atlantic coast north of the 33d parallel, and the 24-hour temperature fall was more than 20° over a great part of New England and the Canadian Maritime Provinces. On the 17th the high area disappeared off the New England coast, and the lowest temperature of the month occurred in an area extending from Harrisburg, Pa., to Lynchburgh, Va., a reading of 4° being noted at Washington, D. C.

VI.—This high area was attended by the principal cold wave of the month in the central valleys and along the eastern slope of the Rocky Mountains. Its approach from the British Northwest Territory was shown by the evening report of the 15th, and by the evening of the 16th it was central north of Montana, with pressure above 30.80 at Swift Current, N. W. T. On this date the line of zero temperature extended to northeastern Kansas and southern Iowa and thence to the Lake region, the temperature was 4° to 6° below freezing on the middle Gulf coast, the 24-hour temperature fall was 20° to 30° in areas in western Montana and in the region north of eastern Montana, and the pressure decreased .54 in 12 hours at Swift Current. During the 17th the center remained nearly stationary north of eastern Montana, with pressure rising above 31.00, the highest reading, 31.06, being noted at Swift Current, and the 24-hour temperature fall was more than 30° in an area extending over the middle-eastern slope of the Rocky Mountains and thence to southern Iowa.

During the 18th the center moved to the upper valley of the Red River of the North, with a decrease of pressure of .20 to .30, the lowest temperature of the month occurred at stations in the Dakotas and eastern Montana, where it was —24° to —45°, the line of zero temperature extended to northern Oklahoma and northern Indian territories, and the temperature fell generally in the central valleys and the Lake region, the 24-hour decrease being more than 30° in areas on the middle and southeast slopes of the Rocky Mountains and over the northern part of the Lake region. The night of the 18th the area appeared to divide, one part moving to the Lake Superior region, and the other passing southward to Kansas where it was joined by a high area which occupied the middle plateau the evening of the 18th. On the 19th the lowest temperature of the month was noted from the Lake Superior and Lake Michigan regions over Texas, the line of zero temperature reached northern Texas, the temperature fell eastward to the Atlantic coast, the 24-hour decrease exceeding 20° in the middle Gulf states and from eastern New York and northeast Pennsylvania over a large part of New England, and at points in Kansas the temperature was the lowest on record for the month.

VII.—During the 18th a short-lived low area moved northeastward along the west Gulf coast and its passage was followed by a rapid increase of pressure over the west Gulf states, the increase at Abilene, Tex., being .34 in 12 hours. The morning of the 19th high area VI was central over Kansas and a ridge of high pressure extended from the Rio Grande Valley to Lake Superior. The evening of the 19th the highest pressure was noted over southeast Texas. Although high areas VI and VII were parts of the same system of high pressure and there was doubtless a transference of high pressure from Kansas to Texas during the 19th, the marked and independent increase of pressure over Texas during the 18th seems to justify the belief that this high area was to a large extent a new development. By the 20th the center had moved to northeast Arkansas, with pressure above 30.40. On this date the line of zero temperature extended over the Ohio Valley, central New York, and central New England, the lowest temperature of the month occurred from the lower lake region over the Ohio Valley and Mississippi, the minimum being 16° at Vicksburg and Meridian, Miss.; a minimum reading of —21° was reported at Forest Park, Saint Louis, Mo., and the 24-hour temperature fall was 20° to 40° in the Atlantic coast states. Moving eastward the center passed off the Virginia coast during the 22d. The cold wave disappeared off the Atlantic coast during the 21st.

VIII.—Appeared off the north Pacific coast on the 19th, and by the morning of the 20th had advanced to east Oregon, with pressure above 30.40. By the evening report the center had moved to northeast Nevada, with pressure above 30.50. On this date freezing weather occurred over the plateau region to the Mexican border, and the temperature fell 10° to 20° over the east part of the middle plateau. From the 21st to 25th, inclusive, the pressure continued high over the middle plateau region, the values rising to 30.80 at Salt Lake City, Utah, the evening of the 22d and the morning of the 23d.

IX.—On the 25th the pressure was high from the middle plateau region to Manitoba, and the evening report showed this high area central over Manitoba, with pressure above 30.40, and a 24-hour temperature fall of more than 30° from the Lake Superior region to Manitoba. During the 26th the center advanced to northern Illinois, with pressure above 30.50, freezing weather to central Kentucky and central Virginia, and a temperature fall of 20° to 40° from the Lake region to the Atlantic coast between the 35th and 43d parallels. Moving southeastward the center reached extreme western Virginia the evening of the 27th, without marked changes in pressure; the line of freezing weather reached the interior of the east Gulf states, and the 24-hour temperature fall was more than 20° over the south Atlantic states. By the evening of the 28th the high area had reached the east part of the Gulf of Mexico, with a decrease of .10 to .20 in central pressure, and a general rise in temperature in the Atlantic coast states.

X.—During the 28th and 29th the pressure was high over the middle plateau region, the readings ranging from 30.40 to 30.50. Number X was apparently an offshoot from this area of high pressure, and the morning of the 30th an area of high pressure extended along and west of the Mississippi River from Wisconsin to the Gulf, with highest pressure in adjoining parts of southwest Missouri and northern Arkansas. On this date the temperature fell generally over the Lake region and the Ohio Valley and Tennessee, the 24-hour fall ranging from 10° in parts of the Ohio Valley and Tennessee to 32° at White River, Ont. During the 31st the center moved to West Virginia; the cooler condition passed off the Atlantic coast, and a marked rise in temperature occurred west of the Alleghany Mountains.

LOW AREAS.

The low areas of January advance eastward at an average rate of about 37 statute miles per hour, the velocity for January and February being the highest noted for the year. The principal track of low areas in January west of the 100th meridian is traced from Vancouver Island south of east over Montana, North Dakota, and the upper lake region. Passing from the upper lakes almost due eastward over Ontario, the middle Saint Lawrence valley, and southern Newfoundland, the principal track bends northward over the Atlantic Ocean towards the Iceland area of low pressure. Less frequented storm tracks are traced from the east part of the middle plateau region, and from the middle and west Gulf states, and join the principal track in the Saint Lawrence Valley, which is the region of greatest storm frequency in North America, with an average of 4 to 5 low areas for the month of January. A secondary track is also traced northeastward along the Atlantic coast. An average of about two low areas per month traverse the North American continent from the Pacific to the Atlantic coasts in January.

The tracks of 13 low areas are plotted on Chart I for January, 1892, this being the average number traced for January during the last 19 years. Four of the low areas advanced from the Pacific coast north of the 45th parallel; 4 appeared over the British Northwest Territory; one apparently developed east of the Sierra Nevada Mountains in southern Nevada; one, a continuation of low area XIV*a* for December, 1891, occupied the middle Mississippi valley at the opening of the month; one originated in western Texas, and 2 are traced from the middle Gulf coast region. Of the Pacific coast low areas, 2, numbers VII and XI, traversed the continent, their rate of advance being 46 and 28 miles per hour, respectively. The Pacific coast and British America low areas generally pursued a course eastward over the Saskatchewan Valley to the 100th meridian, whence they moved east-southeast to the Saint Lawrence Valley, and passed thence north of east over the Gulf of Saint Lawrence. The low areas from the middle Gulf region advanced northeastward to the Gulf of Saint Lawrence. The average velocity of low areas of the current month, 32 miles per hour, was about 5 miles per hour less than the average velocity noted for January of preceding years. On the 16th and 17th and 27th and 28th cyclonic disturbances were indicated in the south Pacific coast region. The following is a description of the low areas traced over the United States and Canada:

I.—Was a continuation of low area XIV*a* for December, 1891, and the morning of the 1st was central over Illinois, with pressure 29.50, and generally stormy weather from the Lake region to Texas. Over Lake Michigan northwest gales of 50 to 60 miles per hour prevailed. High wind, with rain changing to snow, and a marked fall in temperature, occurred in the Lake region, snow fell thence to eastern Kansas, and severe local storms were reported in the Southwest. On this date there was a decrease of pressure of .52 in 12 hours at Knoxville, Tenn. Moving northeastward the center reached Georgian Bay the morning of the 2d, with a decrease of .15 to .20 in central pressure, severe storms from the Lake region to the New England coast, and a marked increase in temperature in the Atlantic coast states, the 24-hour rise being 26° at Lynchburgh, Va. On this date the pressure was relatively high over the Canadian Maritime Provinces, and the center of disturbance passed southeastward and at the evening report occupied an elongated area extending along the boundary line between New York and New England. During the 3d the center occupied eastern New England, where a marked decrease of energy was apparent. On the 4th a decided increase of strength was shown and the center advanced to the west part of the Gulf of Saint Lawrence, and passed thence eastward south of Newfoundland by the morning of the 5th.

II.—Appeared on the north Pacific coast on the 1st, with pressure 29.70, and rain southward over the central valleys of California. During the 2d the center advanced north of Montana, with pressure below 29.60, rain along the Pacific coast north of the 40th parallel and over the northern plateau region, and a marked increase in temperature over Montana. On the 3d the center of disturbance reached Manitoba, with an appreciable loss of energy, a decrease of pressure of .56 in 12 hours at Saint Vincent, Minn., and an increase in temperature of 30° to 40° in 24 hours in North Dakota. Moving southeastward this low area disappeared by an increase of pressure over the Lake region during the 4th.

III.—Apparently developed on the southeast slope of the Rocky Mountains during the 4th, and the morning of the 5th was central near the boundary line of Louisiana and Arkansas, with pressure below 29.60, whence it advanced to the upper valley of the Tennessee River by the evening report, with pressure below 29.50, and rain generally from the Rocky Mountains to New England, the precipitation being in the form of snow north of Tennessee and Virginia. The temperature rose decidedly in the middle and south Atlantic and east Gulf states, and violent storms, assuming the form of tornadoes in northern Georgia and northern South Carolina, occurred in the south Atlantic states. A description of these storms will be found under "Local storms." During the 6th the center advanced to south New England, with pressure below 29.30, a decrease of .50 in 12 hours on the northeastern coast, east gales of 40 to 60 miles per hour on the southeast New England coast, hard gales thence to the Carolinas, a violent thunder and hail storm at Augusta, Ga., in the early morning, and snow, with lower temperature, from the Lake region to the middle Atlantic and New England coasts. During the 7th the center disappeared over the north part of the Gulf of Saint Lawrence without an apparent loss of energy.

IV.—Appeared in the Saskatchewan Valley on the 6th, with pressure below 29.80, whence it moved to Lake Superior by the evening of the 7th, with pressure below 29.60, and snow in the Lake region and extreme northwest. During the 8th this low area apparently disappeared by an increase of pressure north of the Lake region. On this date snow fell in the Ohio Valley and Lake region, and high west to south winds prevailed over the lower lakes.

V.—The evening of the 7th a cyclonic disturbance appeared central over western Texas, with pressure below 29.90, whence

it passed east-southeast and disappeared over the Gulf of Mexico during the 9th, without evidence of marked energy. On the 7th the wind reached a velocity of 42 miles per hour from the south at Abilene, Tex.; on the 8th rain fell on the west Gulf coast; and on the 9th a decided rise in temperature occurred on the middle and east Gulf coasts, and rain fell from Florida to southeast Texas.

VI.—The presence of this low area over the north-central part of the Gulf of Mexico was shown by reports of the 11th, and during the 12th the center advanced across the middle Gulf coast line, with pressure below 29.90, whence it moved northeastward and reached the Gulf of Saint Lawrence the night of the 14th, with central pressure 29.80 to 29.90 throughout its course. This low area was attended by severe rain and sleet storms from the Gulf of Mexico to the Lake region and the New England and middle Atlantic coasts. On the 12th the temperature rose 10° to 20° in the Atlantic coast states, there was a fall in temperature of over 10° from the upper lake region to the west Gulf states, severe rain and sleet storms occurred from Kentucky and West Virginia to the east Gulf states, and snow from eastern Texas to the Ohio Valley. On the 13th very heavy rain fell in the interior of the east Gulf and south Atlantic states, and parts of Tennessee, Maryland, and Virginia, the rain and sleet storm extended to the lower lake region, the temperature rose more than 10° on the immediate Atlantic coast north of Florida, and fell 20° to 30° on the middle Gulf coast, and snow fell generally from the middle Mississippi valley over the Ohio Valley and the eastern Lake region. The morning of the 14th the temperature was high from the Carolinas to south New England, the 24-hour rise exceeding 20° in Virginia and the District of Columbia. In the south Atlantic states the temperature fell rapidly during the day. Snow and sleet fell at New Orleans, La., snow was reported generally in the sugar belt, and very heavy rain fell in Florida.

On the 15th the temperature fell 20° to 30° in the Atlantic coast states, heavy snow fell in the middle Atlantic states, and high north winds prevailed along the Atlantic coast north of the Carolinas.

VII.—Advanced from Vancouver Island to Montana on the 15th, with pressure below 29.90, rain from the north Pacific coast over the northern plateau region, and an increase in temperature of 10° to 20° on the northeast and middle-eastern slopes of the Rocky Mountains. On the 16th the center passed to South Dakota and thence to the Lake Superior region, without evidence of marked strength, whence it moved rapidly to the region north of the Gulf of Saint Lawrence by the evening of the 17th. On the 16th the warmer condition extended to the Alleghany Mountains and Florida, with a 24-hour increase in temperature of 10° to 30° in the central valleys and the Lake region, and snow fell from the middle-eastern slope of the Rocky Mountains over the Lake region. On the 17th the temperature along the immediate Atlantic coast and in the Saint Lawrence Valley fell decidedly, with heavy snow from the western Lake region to the southeast slope of the Rocky Mountains. During the 18th a cyclonic disturbance passed northeast along the west Gulf coast, heavy rain or snow continued from the southeast slope of the Rocky Mountains to New England, and the temperature rose 10° to 20° in the Atlantic coast states. The temperature fell rapidly east of the Mississippi River on the 19th, and the clearing condition reached the Atlantic coast by the 20th.

VIII.—The advance of this low area over the Saskatchewan Valley was attended by an unusually well-defined warm wave or Chinook wind on the eastern slope of the Rocky Mountains from the British Northwest Territory to Colorado. During the 18th the temperature rose 20° to 30° in Alberta. At the evening report this low area appeared over northern Alberta as a disturbance of marked strength, with pressure 29.52 at Edmonton. An area of high pressure occupied the middle plateau region, and a second high area was central over the Red River of the North Valley. Over a great part of the eastern slope of the Rocky Mountains north of Texas the temperature was below zero; over the Dakotas and east and north Montana the minimum temperature was —25° to —45°; over the middle plateau region the temperature was 10° to 30° above zero; over Oregon and Washington it was 35° to 40° above zero; and rain, with south to west winds, set in during the day on the north Pacific coast.

The morning of the 19th the storm-center had moved eastward over the Saskatchewan Valley to the 105th meridian, with pressure 29.50 at Prince Albert, a decrease of pressure of more than .90 in 12 hours being noted in Assiniboia; the pressure had decreased .10 to .20 over the middle plateau; the high area which occupied the Red River of the North Valley at 8 p. m. of the 18th had divided, one part appearing over the north Lake Superior region and the other over Kansas; the 24-hour temperature rise exceeded 50° over the eastern half of Montana; the increase in temperature was more than 30° along the eastern slope of the Rocky Mountains to the 40th parallel; the warmer condition extended over the western part of the central valleys; and a cold wave of marked severity overspread the country from the Gulf of Mexico to the eastern Lake region. Rain was followed by clearing weather on the north Pacific coast; rain or snow fell in the middle and northern plateau regions; and snow in the middle Missouri and Red River of the North valleys. No precipitation was reported on the northeast and middle-eastern slopes of the Rocky Mountains; and south to west winds, reaching a velocity of 30 to 40 miles per hour on the middle and northeast slopes of the Rocky Mountains, prevailed from the north Pacific coast to the 100th meridian.

At 8 p. m. of the 19th the center of disturbance was located over or north of Manitoba, with pressure below 29.60, and a ridge of high pressure extended from Ontario to Texas; a 24-hour temperature rise of more than 40° was noted from Assiniboia and western Manitoba to central Nebraska; the warmer condition had extended to a line traced from Upper Michigan to Louisiana; and the 24-hour temperature fall was 10° to 20° from New England to the east Gulf states. The morning of the 20th the low area was central north of Lake Superior, with pressure below 29.80, and the ridge of high pressure extended from the Saint Lawrence Valley to the lower Mississippi valley; the 24-hour temperature rise was 62° at White River, Ontario, and was 20° to 40° from Manitoba to Texas; the warmer condition extended eastward to a line traced from Lake Huron to the lower Mississippi valley; the fall in temperature was 10° to 30° in the middle and south Atlantic states, and 30° to 40° in New England; and a temperature fall of 10° to 15° was noted on the northeast slope of the Rocky Mountains.

The evening of the 20th the center was north of eastern Lake Superior, with pressure below 29.80, and the pressure was high in the Atlantic coast states and over the middle and southern districts; the 24-hour temperature rise was 20° to 30° in the central valleys and the Lake region; the warmer condition had extended to the Alleghany Mountains; the temperature fall was 10° to 30° in the Atlantic coast states, and 10° to 20° over the east part of the middle plateau region and on the middle and northeast slopes of the Rocky Mountains. Advancing rapidly eastward north of the lower lake region the center reached the Gulf of Saint Lawrence by the evening of the 21st, without an apparent increase of energy; the pressure continued high over the middle and southern districts; the cold wave passed off the Atlantic coast; and a general rise in temperature was noted east of the Rocky Mountains. The precipitation attending this low area was general east of the plateau region, except on the northeast slope of the Rocky Mountains; it was generally light, and was recorded as snow as far south as the Southern and Southwestern States. The wind velocity was greatest, 56 miles per hour from the south at Huron, S. Dak., on the 19th, and a velocity of 55 miles per hour from the southwest was noted at Buffalo, N. Y., on the 21st.

The following copy of a section of the thermograph record sheet at Fort Assinaboine, Mont., covering the period from noon

January 18th to noon January 19th, shows the remarkable temperature change caused by the Chinook wind which commenced at that station the early morning of the 19th, a rise of about 43° being registered in 15 minutes.

Record of thermograph, Fort Assinaboine, Mont., noon January 18 to noon January 19, 1892 (in degrees Fahrenheit).

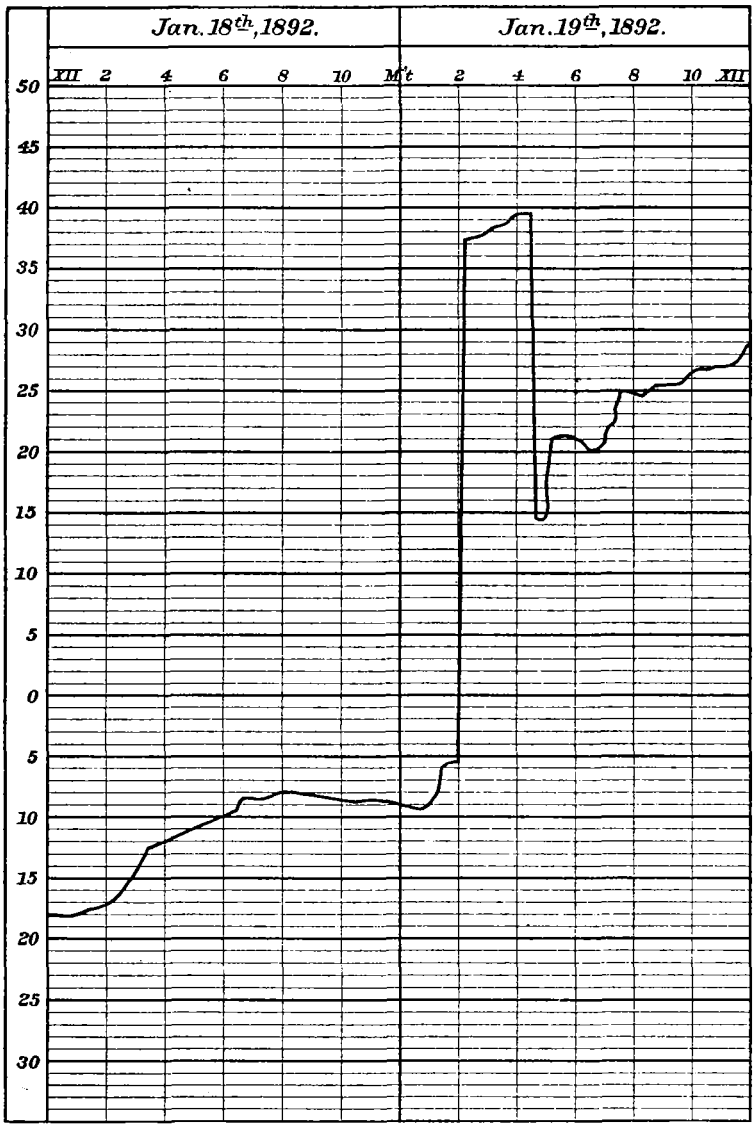

Chart VII, with this number of the REVIEW, shows the general meteorological conditions west of the 90th meridian at the 8 p. m. report of January 18th, which preceded, and at the 8 a. m. report of the 19th, which followed, the temperature change on the eastern slope of the Rocky Mountains above referred to.

A discussion of the warm winter winds of that region will be found under the heading "Chinook winds," in this issue of the REVIEW.

IX.—This low area followed closely number VIII. It appeared over Alberta during the 20th, and the evening of that date the pressure was lowest, 29.54, at Calgary. Unlike the conditions which existed with the appearance of low area VIII the temperature was high, above the freezing point, over the northeastern slope of the Rocky Mountains at this observation; otherwise they were somewhat similar, the pressure being high over the middle plateau region and thence over the middle Mississippi valley, and rain, with south to west winds and temperature 40° to 45°, was noted on the north Pacific coast. The temperature rose 8° to 14° over northern Montana and in Alberta, and fell 10° to 20° over the eastern part of the middle plateau region, with snow in eastern Colorado and Kansas. By the morning of the 21st the center had moved to eastern Assiniboia, with pressure below 29.40. The pressure continued high over the southern and west-central districts; the temperature rise was 20° to 30° in 24 hours in eastern Montana and the British Northwest Territory, and snow fell in Assiniboia.

At the evening report the center was north of Minnesota, with pressure below 29.60; the pressure was high from the middle plateau region to the middle Atlantic coast; the temperature rose generally east of the Rocky Mountains, except on the northeast slope; and snow fell in Assiniboia, Manitoba, and North Dakota. During the 22d the center of disturbance moved eastward north of the Lake region, with pressure below 29.60; the temperature rose east of the Rocky Mountains, except from the extreme upper Mississippi valley over North Dakota and Manitoba, where it fell 10° to 20°; snow fell in the Lake region, and rain in the lower Mississippi valley and the west Gulf states. During the 23d the center passed over the Gulf of Saint Lawrence, with an apparent increase of energy; the warmer condition passed off the Atlantic coast; a decided fall in temperature occurred over the north part of the Lake region; and rain or snow, followed by clearing weather, prevailed east of the Mississippi River.

X.—Followed closely number IX. It appeared over Alberta the morning of the 22d, with pressure below 29.90, and passed thence eastward to the 105th meridian by the evening report, with pressure falling below 29.70. No rain or snow fell in the Northwest; the temperature rose 5° to 16° on the northeast slope of the Rocky Mountains; and wind velocity of 30 to 40 miles per hour from southwest to northwest was noted over Montana and North Dakota. During the 23d the center moved north of Lake Superior, with pressure below 29.70; light snow fell over the east Lake region, and the temperature rose 30° to 40° in the Red River of the North Valley. Moving slowly eastward, with a marked decrease of pressure, the center reached the region north of the lower lakes during the 24th. The temperature rose 10° to 40° over the Lake region, the increase being greatest at White River, Ont.; snow fell in the eastern Lake region and along the Atlantic coast north of the 40th parallel; and brisk to high westerly winds prevailed over the Great Lakes.

By the evening of the 25th the center reached the Maine coast, with pressure below 29.40. The temperature rose 10° to 20° in the middle Atlantic and New England states; light rain or snow fell from the eastern Lake region over New England; and high westerly winds prevailed along the Atlantic coast to the Carolinas. On the 26th the center remained nearly stationary near the east New England coast, with pressure falling to 29.20. The temperature rose 10° to 20° over the Canadian Maritime Provinces, elsewhere east of the Rocky Mountains there was a decided fall in temperature; northwest gales of 50 to 60 miles per hour prevailed along the coast from south New England to Virginia; and snow fell from the lower lakes over New England. By the morning of the 27th the center had passed east of Nova Scotia; high winds, reaching a velocity of 56 miles per hour from the northwest at Woods Holl, Mass., continued along the middle Atlantic and New England coasts during the 27th; and the clearing condition attending high area IX extended to the Atlantic coast.

XI.—Appeared off the north Pacific coast on the 25th, with pressure below 29.50; east to southeast winds of 60 to 70 miles per hour occurred along the Washington coast; and rain fell in Oregon and north California. During the 26th the low area advanced to Alberta, with pressure below 29.60; rain fell over the west part of the plateau region and along the Pacific coast to San Diego, Cal.; and a 24-hour temperature rise of 10° to 20° was noted over Utah and western Colorado. On the 27th the center reached Manitoba, with slight changes in central pressure; scattered rains fell in the Northwest and along the Pacific coast; the temperature rose 10° to 30° from the Rocky Mountains over the Lake region, a 24-hour rise of 38° being noted at White River, Ont.; and high south to west

winds prevailed in the Missouri Valley. Moving slowly eastward during the 28th the center reached the region north of Lake Superior, and passed thence southeast to the lower lake region by the evening of the 29th.

On the 28th the 24-hour temperature rise was 10° to 20° in the Atlantic coast states; rain or snow fell from the lower lake region over New England; and high south to west winds prevailed over the Great Lakes. On the 29th the temperature rose 10° to 20° along the Atlantic coast and in the east Gulf states; rain or snow fell from the Lake region and Ohio Valley over the middle Atlantic and New England states; and brisk to high winds shifting to north and west prevailed over the Lakes. Moving southeast, the low area was central off the middle Atlantic coast the morning of the 30th, whence it moved slowly northeastward, and at the close of the month was central south of Newfoundland, with pressure below 29.50. During the last two days of the month destructive north to northeast gales prevailed along the New England coast; the winds were heavy along the coast to the Carolinas; and cooler, clearing weather extended over the coast line.

XII.—Appeared off the north Pacific coast and passed thence to Alberta during the 29th, with pressure below 29.40 at the evening report. The temperature rose 10° to 20° on the northeast slope of the Rocky Mountains, and rain fell on the north Pacific coast. The center moved to Manitoba during the 30th, with an increase of about .30 in pressure. The warmer condition extended to the Lake region, and the temperature fell 10° to 20° on the northeastern slope of the Rocky Mountains. No precipitation attended this low area east of the Rocky Mountains.

XIII.—During the 29th the weather was unsettled on the south Pacific coast and over the south part of the plateau region, and rain fell from southern California to western Texas. During the 30th the 12-hour decrease of pressure was .10 to .20 in that region, a decrease of .20 being noted at Keeler, Cal. At the evening report of the 30th a low pressure area was apparently central on the eastern slope of the Sierra Nevada Mountains south of the 40th parallel; rain fell from California over the middle and southern plateau regions, the rainfall being very heavy over parts of the southern plateau; and a wind velocity of 40 miles per hour from the west was noted at Tucson, Ariz. Advancing rapidly eastward the center reached northern Kansas the evening of the 31st, with pressure below 29.80. The 24-hour temperature fall at the morning report was more than 30° in southern Assiniboia, and this condition advanced to the middle-eastern slope of the Rocky Mountains by the evening report; rain or snow fell from the middle and southern plateau regions to the Lake region; and the wind reached a velocity of 40 miles per hour from the south at Amarillo, Tex.

Tabulated statement showing principal characteristics of areas of high and low pressure.

Barometer.	First observed.			Last observed.				Maximum pressure change in 12 hours, maximum temperature change in 24 hours, and maximum wind velocity.									
	Date.	Lat. N.	Long. W.	Lat. N.	Long. W.	Duration.	Velocity per hour.	Station.	Rise.	Date.	Station.	Fall.	Date.	Station.	Direction.	Miles per hour.	Date.
High areas.		°	°	°	°	*Days.*	*Miles.*		*Inch.*			°					
I	1	39	110	29	84	6.5	29	Swift Current, N. W. T	.50	5	Omaha, Nebr	30	6	Fort McKinney, Wyo	n.	42	5
II	1	52	104	49	87	2.0	17	Fort Smith, Ark	.60	1	White River, Ont	48	2	Chicago, Ill	nw.	42	3
III	8	51	110	49	66	2.5	44	Qu'Appelle, N. W. T	.38	7	do	26	9	Kitty Hawk, N. C	ne.	52	10
IV	11	40	100	40	110	2.0	21	Salt Lake City, Utah	.30	11	Cheyenne, Wyo	24	11	Montrose, Colo	e.	26	11
V	12	51	122	43	68	4.5	26	Sydney, C. B. I	.40	17	White River, Ont	38	14	Block Island, R. I	n.	36	17
VI	16	52	110	38	97	2.5	21	Swift Current, N. W. T	.54	16	Wichita, Kans Abilene, Tex	34 34	17 18	Bismarck, N. Dak	nw.	30	17
VII	19	29	98	36	79	2.0	29	Abilene, Tex	.34	18	Wilmington, N. C	32	20	Narragansett Pier, R. I	nw.	30	22
VIII	19	47	125	41	116	1.0	25	Qu'Appelle, N. W. T	.50	20	Cheyenne, Wyo	20	20	Helena, Mont	sw.	36	22
IX	25	52	97	29	87	3.0	28	White River, Ont	.64	25	White River, Ont	46	26	Kitty Hawk, N. C	n.	38	27
X	30	38	95	39	80	1.5	22	Port Huron, Mich	.36	30	Pueblo, Colo	24	28	Hatteras, N. C	n.	28	31
Mean						2.8	26		.46			32				36	
Low areas.									Fall.			Rise.					
I*	1	40	90	48	65	3.5	20	Knoxville, Tenn	.52	1	Lynchburgh, Va	26	2	Chicago, Ill	nw.	60	1
II	2	48	125	43	87	2.0	45	Saint Vincent, Minn	.56	3	Fort Buford, N. Dak	38	3	Fort Canby, Wash	s.	48	2
III	5	33	93	48	68	2.0	39	Boston, Mass Chatham, N. B	.50 .50	6 7	Montgomery, Ala	24	5	Block Island, R. I	e.	60	6
IV	6	52	103	48	83	2.0	23	Medicine Hat, N. W. T	.54	6	White River, Ont	28	8	Buffalo, N. Y	sw.	48	8
V	7	33	102	28	92	1.5	17	Galveston, Tex	.18	8	Pensacola, Fla	27	9	Abilene, Tex	s.	42	7
VI	12	29	90	49	67	2.5	32	New York, N. Y	.32	13	Wilmington, N. C Washington, D. C	24 24	12 14	Pensacola, Fla	s.	38	12
VII	15	49	125	50	68	2.5	46	Prince Arthur, Ont	.56	16	Rapid City, S. Dak Sault de Ste. Marie, Mich	34 34	16 17	Fort Canby, Wash	s.	38	15
VIII	18	53	115	47	77	2.5	29	Qu'Appelle, N. W. T	.92	19	White River, Ont	62	20	Huron, S. Dak	sw.	55	19
IX	20	51	113	47	66	2.5	39	do	.70	21	do	58	22	Fort Assinaboine, Mont	sw.	48	21
X	22	53	113	45	67	4.5	22	White River, Ont	.46	23	do	44	24	Woods Holl, Mass	nw.	56	27
XI	26	47	125	42	65	5.0	28	Duluth, Minn	.48	27	do	38	27	Fort Canby, Wash	se.	69	25
XII	29	49	127	48	88	2.0	37	Calgary, N. W. T	.68	29	do	36	31	do	s.	61	29
XIII	30	37	118	40	98	1.0	42	Pueblo, Colo	.26	31	Wichita, Kans	16	31	Tucson, Ariz	w.	40	30
														Amarillo, Tex	s.	40	31
Mean						2.6	32		.51			35				51	

*Continuation of low area XIVa for December, 1891.

NORTH ATLANTIC STORMS FOR JANUARY, 1892 (pressure in inches and millimeters; wind-force by Beaufort scale).

The paths of storms that appeared over the west part of the north Atlantic Ocean during January, 1892, are shown on Chart I. These paths have been determined from reports of observations by shipmasters received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

In January there is usually an increase of pressure over the southern parts of the north Atlantic Ocean, the increase exceeding .05 in an area about midway between the Azores and Windward West Indies. Over the northern part of the ocean there is a decrease of pressure. The storms of this month generally advance over the ocean from the Canadian Maritime Provinces, and move thence in an east-northeast to northeast course toward the Iceland low area. The average number of storms that traverse the north Atlantic from coast to coast in January is 2.5, and in a majority of instances these storms skirt the southern quadrants of the Iceland low area and pass